10:00am, Friday, Nov. 14

Bldg 50 Auditorium

Gravitational Waves from a Pulsar Kick Caused by Neutrino Conversions

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It has been suggested that the observed pulsar velocities are caused by an asymmetric neutrino emission from a hot neutron star during the first seconds after the supernova collapse. We calculate the magnitude of gravitational waves produced by the asymmetries in the emission of neutrinos. The resulting periodic gravitational waves may be detectable by LIGO and LISA in the event of a nearby supernova explosion. In this talk I will discuss these results, their derivation and implications. Based upon astro-ph/0309362

Bldg 70 Room 191

Helicity Zero Particles

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We consider the possibility that a vector particle with mass might exist in only one helicity state, rather than the usual three states with helicity equal to +1, -1, and 0. Massless particles, of course, need only have one helicity state. (For invariance under parity, they need two.) We show that a massive vector particle can exist only in the helicity-0 state, if it is composed of a fermion-antifermion pair and they are massless. This requires the mass to be generated by the interaction between the massless particles. An interaction of the form PSI-bar gamma-mu PSI is attractive between particle and antiparticle and preserves helicity. We will discuss a method for distinguishing an helicity-0 vector particle from both a spin-0 pseudoscalar particle and a spin-1 vector particle.

10:20am, Friday, Nov. 14

Bldg 50 Auditorium

Measure the Radius of the Earth

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An unusual photograph through a telescope of two San Francisco bridges clearly shows the curvature of the Earth. Measurements from this photo, bridge dimensions, and a few calculations result in a calculated radius of the Earth surprisingly accurate! In a classroom setting, degrees of complexity of the problem can be exposed appropriate to the level of student inquiry. The unusual juxtaposition of the bridges is intriguing to the student as well as challenging, such as if refraction is taken into account. A step-by-step procedure for student exploration is outlined in this talk, with additional topics concerning refraction of the atmosphere and Fermat's principle.

Bldg 70 Room 191

Orbital angular momentum vs explaining Planck's Constant

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New identities called "Maxwellian decompositions" show that "quantum directionality" should denote the property previously called "orbital angular momentum," and there is no physical orbital angular momentum in the states such as the H-atom 2P first excited state. There is a -1 change in the state of quantum directionality during the 2P-to-1S de-excitation. The transition releases a spin-zero photon that can be modeled as a weak shock N-wave disturbance in a kinetic gas space medium that has the huge medium density of string theory. The speed of sound in the medium is our speed of light c. Transport processes act so as to smear out the N-wave shock fronts to thicknesses proportional to the mean free path of the mass minimal grain. This constrains properties of the photon such that its energy times wavelength equals c times Planck's constant. In this model Planck's constant becomes a quantity calculated in terms of properties of the space medium. The N-wave photon seems capable of manifesting transversality, polarization and compatibility with special relativity.

10:40am, Friday, Nov. 14

Bldg 50 Auditorium

Searches for WIMP Annihilation In the Gamma-Ray Sky

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Recent advances in experimental cosmology have provided evidence that most of the matter content of the universe is composed of "non-baryonic dark matter": a form of stable matter from beyond the Standard Model of particle physics. Thermal production of cold non-baryonic dark matter in the early universe implies particle masses in the multi-GeV range and interaction cross-section similar in magnitude to that of the Standard Model weak interaction. The particles are produced with non-relativistic velocities and are compatible with the "cold dark matter" paradigm for structure formation. Stable, weakly interacting, non-relativistic, multi-GeV mass particles (i.e. WIMPs) are probably a manifestation of a new fundamental symmetry of nature, such as Supersymmetry or Universal Extra Dimensions. Searches for WIMP annihilation in gamma rays from space based detectors were established by EGRET, which will soon be superseded by GLAST. The spectral signatures for WIMP annihilation in space based detectors include a gamma ray "continuum" from neutral pions produced in hadronization of tree-level final state quark-antiquark pairs, as well as gamma ray "lines" from 2-photon production in higher loop diagrams. We summarize the results on searches for both signatures with EGRET data and how these will be improved upon by GLAST. Closely related WIMP annihilation signatures from other energy bands include TeV-scale gamma rays detected by ground based detectors, as well as radio waves produced in synchrotron radiation from electrons produced in hadronization of final state quark-antiquark pairs. We summarize the status of EGRET multi-wavelength searches from two potential sources, the galactic center and galactic satellites. Finally, we discuss how results from direct detection experiments impact the indirect searches and conclude with a WIMP search "roadmap".

Bldg 70 Room 191

The Three Eras of This Dynamic Universe

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PhD co

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One: "The Galilean-Newtonian Era;" Two: "The Lorentz-Einstein Era;" Three: "The Castellano, Twenty-first Century Philosophy." Is said Philisophy, THE "Omega Philosophy?" Three Proofs are presented.

11:00am, Friday, Nov. 14

Bldg 50 Auditorium

Chaotic Dynamics as a Possible Source of Anomalies in High Energy Astrophysical Observations

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Recently it has been suggested that global Lorentz invariance is only an approximate symmetry of nature that may be broken for elementary particles participating in high energy interactions. In particular, it has been argued that violation of Lorentz invariance may provide a satisfactory answer to anomalies involving observation of ultrahigh energy cosmic rays and TeV-photon spectra. Since breaking the Lorentz invariance amounts to violation of Special Relativity, it is highly desirable to search for alternate explanations of these anomalies. In particular, the dynamical effect of large fluctuations in the interaction energy needs to be accounted for. The paper presents a possible solution that complies with Relativity and is based on Hamiltonian chaos and fractional diffusion equations.

Bldg 70 Room 191

Forces Between Electrical Current Elements

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The momentum of a charged elementary particle, P=MV qA, where M, V, q and A are respectively its mass, velocity, charge and impinging vector potential, implies existence of the force ddF = ddF(magnetic) plus (bII')(rE3)(ds.ds')r where ddF, ds, ds' and r are vectors, (rE3) is scalar and b is the units-defining constant; ddF is exerted on current element Ids by current element I'ds', both fixed in the laboratory frame. Force ddF causes a nonuniform distribution of charge along the circuit(s) containing Ids and I'ds' whose field in effect transfers ddF from conduction electrons to ions. Integral of ddF is tensile between points of a rectilinear portion of circuit. If current element Ids has velocity w, with I'ds' fixed, ddF acts both on conduction electrons as when w=0, and on the electrons and nuclei of the ions in ds due to their current elements I"ds=dq"w. The resulting polarizations in effect transfer ddF from conduction electrons to ions. J.P. Wesley's qualitative assumption is confirmed.

11:20am, Friday, Nov. 14

Bldg 50 Auditorium

Measuring Cosmic Microwave Background Polarization with Polarbear

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B-mode polarization measurements of the Cosmic Microwave Background (CMB) have the potential to probe the inflationary era, measure large scale stucture via gravitational lensing of the CMB, and to improve measurements of many cosmological parameters. However, there are significant challenges that must be addressed in order to fully characterize the polarization of the CMB. The signals of interest are extremely faint and have to be measured in the presence of large interfering signals. Therefore, the design of experiments simultaneously requires high sensitivity and high rejection of systematic errors. We discuss POLARBEAR, an experiment being built to characterize the anisotropy of the CMB polarization. POLARBEAR will use a 3m off-axis telescope and a large bolometer array receiver. The array will use superconducting transition-edge sensors (TES) read out by superconducting quantum interference devices (SQUID). To reject systematic errors, several levels of signal differencing are planned.

Bldg 70 Room 191

Bohr's Atom Completed: The Rutherford-Santilli Neutron

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The Rutherford-Santilli neutron n* is considered classically with intrinsic inductive momentums. It is the true ground state of Bohr's hydrogen atom and is subject to orbital capture. Spin-flip of the electron e followed by fusion with a positively charged constituent of the proton p and emission of a gamma photon forms a negatively charged constituent of the resultant isomer of n*: the conventional neutron n. The assumed existence of n* requires that e, acted on by the intense magnetic induction field of p, be mutated to spin and magnetic dipole moment respectively 0.0379h/4(pi) and 3.58 x (10EC26) SI, with g-factor 0.516 and c.m. fixed w.r.t. p. The intrinsic structure of the electron is considered from this standpoint. Stability of n* requires external electromagnetic fields whose magnitudes are present in the interiors of nuclei. Absent such field strengths, or with spin-flip of the electron, n* n plus gamma.

11:40am, Friday, Nov. 14

Bldg 50 Auditorium

Evidence that a Reformed Physics Course has Lasting Impact on Student Learning and Performance

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We examined the performance of biology majors (N = 6653) in an upper-level physiology course at UC Davis and found that a student grade is significantly influenced by the kind of physics course they had previously taken (reformed or traditional at UC Davis or traditional elsewhere). Our dependent variable for this analysis is the letter grade in the physiology course, collapsed into three categories. We modeled this categorical grade as a function of graduation GPA, gender, and kind of physics course. Our results are significant across a wide range of model specifications and provide solid evidence that students who took the reformed physics course, Physics 7 at UC Davis, had a statistically significant grade advantage in the subsequent physiology course, compared to those who took a traditional physics course at UC Davis or elsewhere. In an ordered logistic regression model the indicator variable for taking the reformed physics course had a positive coefficient of 0.334 that was significant at the 0.001 level. One illustration of the size of the effect is that taking the reformed physics course, Physics 7, (as opposed to a traditional course) increases the odds that a student will get a B+ or higher in the physiology course by a factor of 1.4.

Bldg 70 Room 191

Einstein's 1905 Electrodynamics Paper

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Einstein's derivation of the Lorentz equations seems to deliberately ignore the easy start possible from x' being linearly dependent on x-vt, instead obtaining at the outset the time equation: ct' is shown to linearly depend on ct-xv/c by application of his clock synchronization rule to 3 independent out and back light signals. His ct' equation is then used to "obtain" the form of the equations for x',y',z' in terms of x,y,z,ct by use of 3 independent out-only signals. These last three parts of his proof are seriously mathematically flawed. E.G. in "deriving" the x' equation, the equivalence of the S and S' signal equations is, in effect, freely used to exchange x and ct in x'=ct' so that the function (ct-xv/c) becomes (x-vt). As long as one stays on the chosen ray of the light cone, these substitutions are allowed, but as soon as one claims the resulting equation to be true for all space-time, the substitutions become inadmissible. Replacement thought experiments (with correct derivations) which still fit in with Einstein's logical plan will be presented. A fuller account is available as a preprint.